SVX4 Current Studies of July 30, 2002

Len Cristofek, Petros Rapidis, Bill Reay and Aaron Reinhard

SVX4 currents were measured for a variety of chip settings and bias voltages. There was a small dependence on chip output driver current and a dramatic dependence on chip bias. The latter will have a major impact on requirements for low-voltage power supplies.

Only one version 2 chip was measured in CDF mode. Several chips must be measured in D0 mode, and tests also should be performed to determine the effect of radiation damage.

Connections between AVDD and DVDD were eliminated both on the chip carrier and the adapter board. The board had none, while a bond connection found on the chip carrier was removed. SVDD (used during readout) and its ground were connected to DVDD and its ground on the chip carrier.

The current probe was calibrated using a 5 V supply voltage and a 200 ohm resistor. Expected and measured currents were 25 ma and 24 ma, respectively. A single cable was attached to the power supply with the least ripple, then subsequently teed and connected separately to AVDD and (SVDD+DVDD). Currents could be measured as a sum or separately.

Data was acquired using single-event read all runs in CDF mode with cal inject every 10^{th} strip. Separately measured currents agreed with their sum to within a few percent. Currents measured in different runs also agreed to within a few percent, and were recorded only if correct pedestal readout had been accomplished. As unsaturated cal inject was performed only on every 10^{th} line, SVDD current may not have been maximized during readout.

Figure 1 shows AVDD and (DVDD+SVDD) currents measured separately as well as the sum. Bias at the chip carrier was 2.44 volts. A green line found in all figures is extraneous.

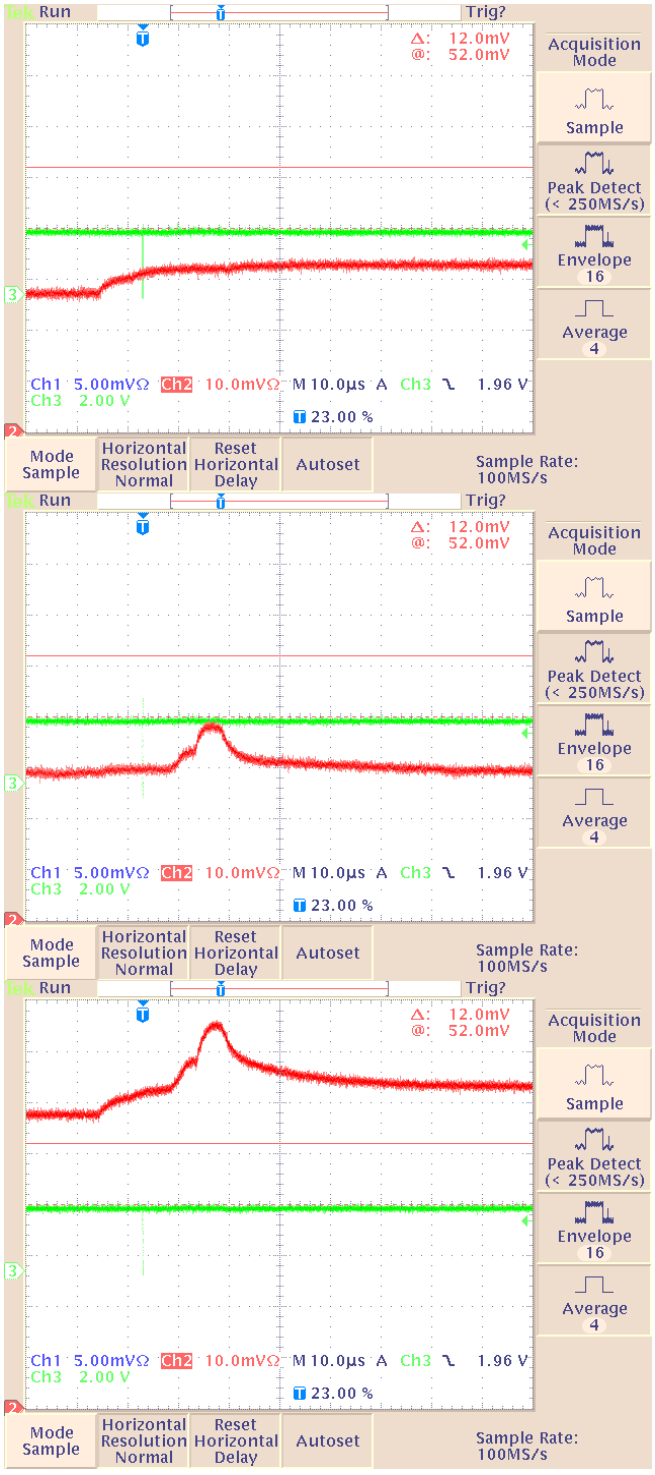

Figure 1. AVDD, (DVDD+SVDD) and measured total currents are shown on the top, middle and bottom, repectively. The vertical scale is 20 milliamps/division and zero is at the lower left-hand corner. The peak on (DVDD+SVDD) is probably due to readout. Individual currents add to the total current within a few percent.

Though more investigation is required, hybrid currents required probably consist of the peak above wings added to the total current after readout multiplied by the number of chips. For a 10-chip hybrid, that would be (126 ma X 10) + 24 ma = 1.5 Amps. To test this interpretation, currents will be measured on a 2-chip hybrid.

It is not understood why the AVDD current is higher after readout than before. As shown in Figure 2, this effect has a long time constant.

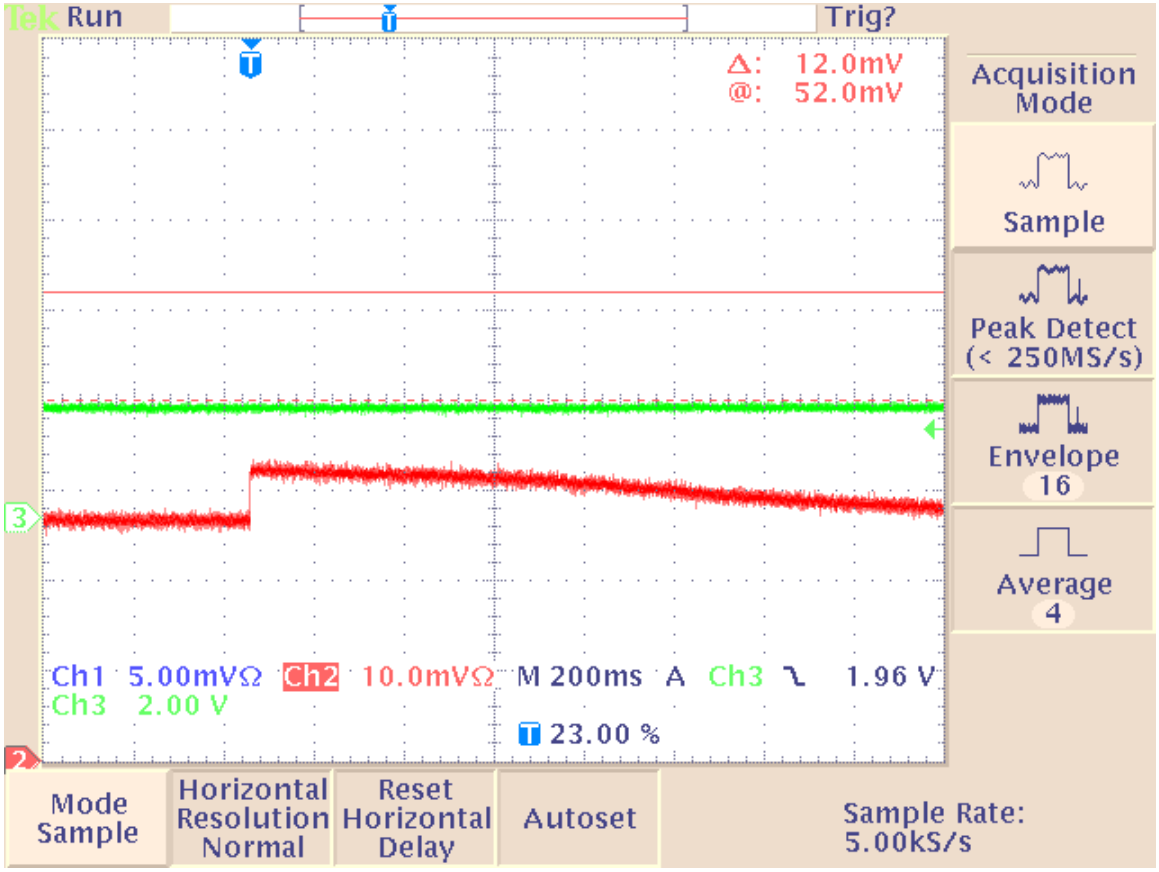

Figure 2: AVDD versus time. The vertical scale is 20 milliamps/division, with the zero indicated by the red arrow at the lower left-hand corner. The jump in current after readout is almost 20%. The horizontal scale is 200 milliseconds/division, thus the effect lasts for more than a second.

The output driver was varied over its maximum range from id=1 (smallest current) to id=7 (largest). The AVDD current was constant, but the (DVDD+SVDD) current varied by almost 20%, as shown in figure 3.

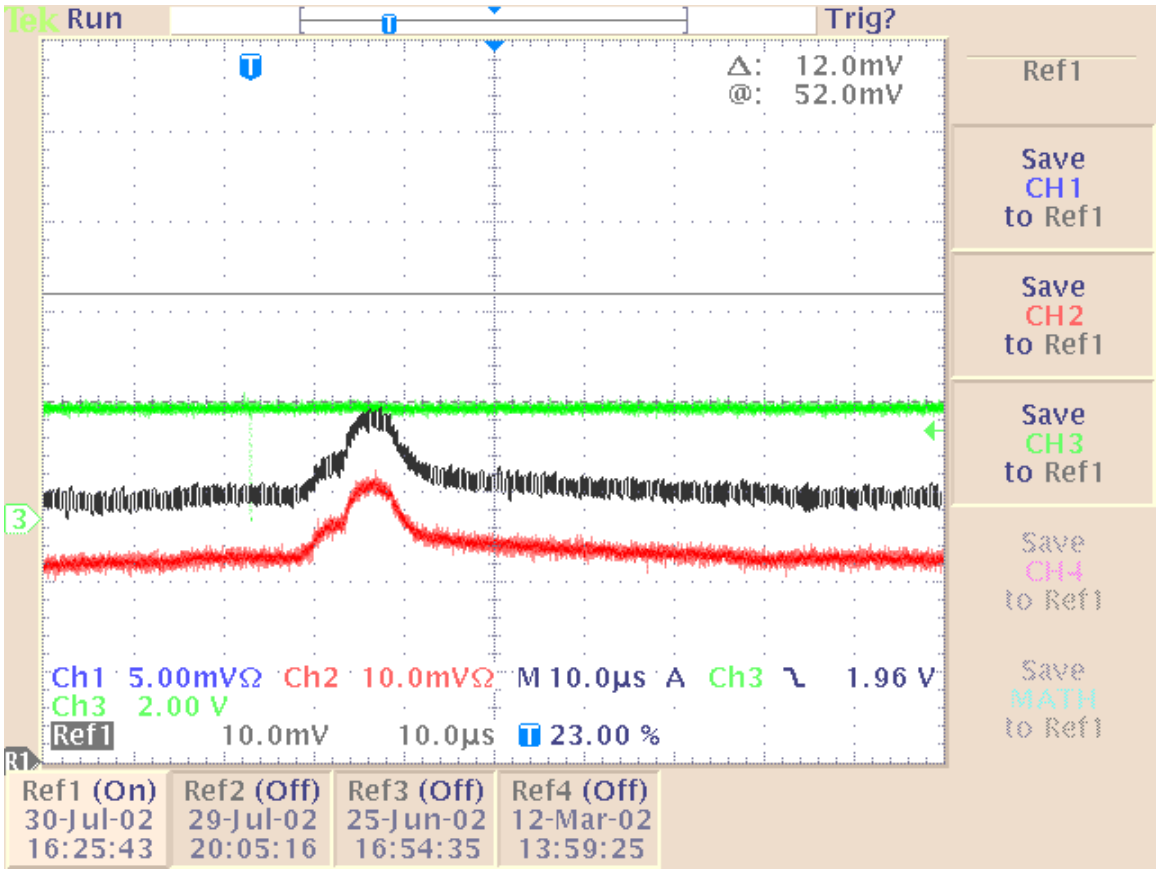

Figure 3: DVDD currents measured as a function of time at 10 microseconds/division. The higher (black) curve is for id=7 (maximum output current), while the lower (red) curve is for id=1 (minimum output current). One major vertical division corresponded to 20 milliamperes, and zero was at the lower left-hand corner. Peak currents were 76 and 62 ma, respectively. Note that DVDD currents before and after readout were approximately the same.

Finally, total SVX4 current as a function of bias voltage is displayed in figure 4. Current increases approximately a factor of two between bias voltages of 2.25 V and 2.75 volts. Bias was measured at the chip carrier; supply voltages were higher by a few hundreds of a volt.

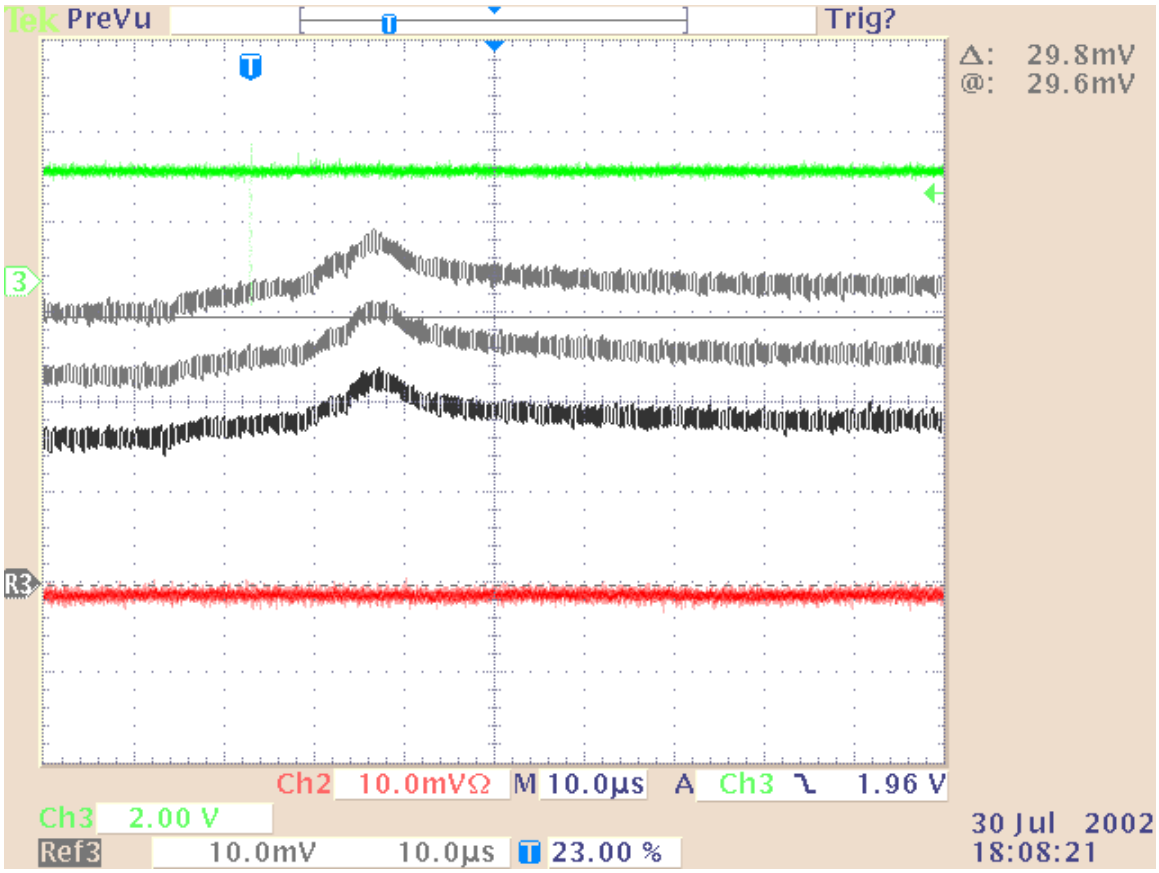

Figure 4: Total SVX4 current as a function of bias voltage with the maximum output current (id=7). The highest curve is for 2.75 volts on the chip carrier, the middle curve is for 2.50 V and the lowest curve for 2.25 V. The horizontal scale is 10 microseconds /division, the vertical scale 50 milliamps/division, and the red line represents zero current.